Metal Progress

VOLUME 65—JANUARY TO JUNE 1954

ERNEST E. THUM, *Editor*

MARJORIE R. HYSLOP, *Managing Editor*

JOHN PARINA, JR., *Associate Editor*

FLOYD E. CRAIG, *Art Director*

METAL PROGRESS IS OWNED, PUBLISHED AND COPYRIGHTED BY

THE AMERICAN SOCIETY FOR METALS

WILLIAM H. EISENMAN, *Secretary*

7301 Euclid Avenue, Cleveland 3, Ohio

The American Society for Metals is not responsible for statements or opinions printed in this publication.

Subject Index for Vol. 65

The subject headings used in this index are chosen in accordance with the ASM-SLA Metallurgical Literature Classification, published by the American Society for Metals, 1950

Aluminum
Aluminum Alloys for Permanent Mold and Die Casting, Compiled by H. S. Jerabek and F. M. Howell *(ds)* 5-112B
Aluminum Everywhere *(cp)* 6-113
Correction to Data Sheet on Wrought Al Alloys, by F. M. Howell *(c)* 1-122
Effects of Loading and Straining Rates on the Stress-Strain Curve, by N. Krupnik and Hugh Ford *(d)* 5-168
Postwar European Progress in Wrought Aluminum and Its Alloys, by Paul Brenner 1-112
Properties of Aluminum Bearings, by Arthur B. Shaw *(d)* 2-185
Quality Control in the Production of Wrought Aluminum Alloys, by R. T. Staples and H. J. Hurst *(d)* 1-136
Recrystallization Behavior of Aluminum, by W. M. Williams and R. Eborall *(d)* 3-130
Recrystallization in Aluminum Alloys, by W. M. Williams and R. Eborall *(d)* 4-156
Strain Markings in Aluminum Alloys, by W. H. L. Hooper *(d)* 6-166
Ventilators Flame Brazed to Aluminum Roofs, by F. J. M. Smith *(d)* 6-156
Wrought Aluminum Alloys—Compositions, Properties and Designations; Compiled by F. M. Howell and H. S. Jerabek *(ds)* 6-112B
Yield Phenomena of Aluminum Alloys, by V. A. Phillips *(d)* 5-200

Aquadag
Mold Lubricant *(sr)* 3-110

Atomic energy
Amendments to the Atomic Energy Act 4-101
American H-Bomb Tests (Extracts From Statement by Lewis L. Strauss) 5-96
The H-Bomb and Its Detection 6-102
Launching of the Nautilus *(cp)* 3-79
Metallurgy at Los Alamos, 1943-1945, by Cyril Stanley Smith 5-81
The New Radiometallurgy Laboratory at the Hanford Atomic Operation, by Thomas W. Gore 6-81
President Eisenhower's Atomic Proposals 2-81
The Road Ahead; Extracts From an Address by Thomas E. Murray 3-107
Role of Beryllium in the Atomic Energy Program, by Robert E. Pahler 4-86

Bearings
Properties of Aluminum Bearings, by Arthur B. Shaw *(d)* 2-185

Beryllium
Fabrication of Beryllium by Powder Metallurgy, by Wallace W. Beaver 4-92
Role of Beryllium in the Atomic Energy Program, by Robert E. Pahler 4-86
Sources, Supplies and Uses of Beryllium, by Robert F. Griffith 4-81

Biographies
James Bliss Austin—A Biographical Appreciation, by Myron Weiss 2-82

Blast furnace
The Low-Shaft Furnace, by H. Malcor *(d)* 4-190

Blistering
Remedy for Hydrogen in Brass Sheets, by R. Eborall and A. J. Swain *(d)* 3-196

Boron nitride
Furnace Insulation *(sr)* 3-108

Brass
Remedy for Hydrogen in Brass Sheets, by R. Eborall and A. J. Swain *(d)* 3-196

Brazing
Ventilators Flame Brazed to Aluminum Roofs, by F. J. M. Smith *(d)* 6-156

Brazing, stainless steels
Brazing *(sr)* 3-108

Brittleness
Intergranular Brittleness, by W. P. Rees and B. E. Hopkins *(d)* 2-178

Cast iron
The Rise and Fall of the Raines Law Sandwich, by Waldimir Anderson 2-84

Cast iron, nodular
Metallurgical Impasse in Welding Nodular Irons, by Edward E. Hucke and Harry Udin *(d)* 2-174

Casting
Aluminum Alloys for Permanent Mold and Die Casting, Compiled by H. S. Jerabek and F. M. Howell *(ds)* 5-112B
A Basic Treatment of Casting Problems; Review by Harold J. Roast of "The Casting of Nonferrous Ingots", by Leslie Aitchison and Voya Kondic *(br)* 4-98
Mold Lubricant *(sr)* 3-110
Production of Sound Castings, by E. C. Mantle, R. A. Skinner and R. W. Ruddle *(d)* 3-186
Sound Castings by Controlling Heat Transfer, by C. A. Parlanti *(d)* 2-126

Casting, precision investment
Advanced Technique for Making Precision Castings, by R. R. Dohrmann *(d)* 2-196

Casting, shell molding
Advanced Technique for Making Precision Castings, by R. R. Dohrmann *(d)* 2-196
Casting Stainless Steel in Shell Molds, by H. J. Cooper and M. L. Katz 4-107

Cathodic protection
Cathodic Protection of Ferrous Metals, by Heinrich Klas *(d)* 1-142

Chromate coatings
The Effects of Chromate Films on the Corrosion Resistance of Hot Dip Galvanize in Brine, by Frank J. Bubsey 5-122

Chromium
Chromium Diffusion Into Steel, by T. Bishop *(c)* 2-112
Ductility of Pure Chromium, by A. H. Sully, E. A. Brandes, and K. W. Mitchell *(d)* 2-208

Cleaning
The Blast Cleaning of Metal Surfaces, by Victor F. Stine 6-104
A Simple Test for Determining Efficiency of Metal Cleaning, by Arnold Miller and Edward A. Hedman *(d)* 5-182
Surface Preparation of Steel for Painting, by Joseph Bigos 4-123

Controlled atmospheres
Dew Point—A Means of Measuring the Carbon Potential of Prepared Atmospheres, by Norbert K. Koebel 2-90
Equilibrium Between Steels and Dew Points of a Prepared Furnace Atmosphere, by Norbert K. Koebel *(ds)* 2-96B

Copper
How Corrosion Pits Form in Water-Immersed Copper Alloys, by R. May *(d)* 5-164
Introduction to Directionality in Copper, by G. L. J. Bailey *(d)* 5-190
Oxidation Resistant Copper Alloys, by J. P. Dennison and A. Preece *(d)* 2-138
Production of Sound Castings, by E. E. Mantle, R. A. Skinner and R. W. Ruddle *(d)* 3-186
Quality Control in the Production of Copper and Its Alloys, by J. Sykes *(d)* 2-186

Corrosion
How Corrosion Pits Form in Water-Immersed Copper Alloys, by R. May *(d)* 5-164
Influence of pH on the Corrosion of Metals, by A. Ya. Shatalov *(d)* 4-174
Intercrystalline Corrosion of Zinc-Aluminum Alloys, by C. W. Roberts *(d)* 5-154

Corrosion tests
Portable Ultrasonic Instruments, by Peter K. Bloch 3-161

Cracks
Method for Revealing Hairline Cracks *(sr)* 3-109
Quench Cracks in Wrought Steel Tubes, by Cyril Wells 5-113

Crucibles
Crucibles for Difficult Jobs, by M. A. Schwartz, G. D. White and C. E. Curtis *(d)* 3-198

Deboronization
Deboronization of Steels, by J. C. Shyne and E. R. Morgan 6-88

Deoxidation
Oxygen in Iron-Vanadium Melts, by R. A. Karasev, A. Yu. Polyakov and A. M. Samarin *(d)* 3-178

Diffusion coatings
Chromium Diffusion Into Steel, by T. Bishop *(c)* 2-112

Dilatometry
Highly Sensitive Dilatometer, by L. L. Wyman *(d)* 2-202

Dislocations
Dislocations, or What Makes Metals So Weak? by W. T. Read, Jr. 2-101

Education
Directory of Degree Programs in Metallurgy, by A. Bornemann *(ds)* 3-96B
Metallurgical Education in the United States, by Alfred Bornemann 3-97

Elastic properties
Dynamic Determination of Elastic Constants, by M. E. Fine *(d)* 5-184

Electrical equipment
Project Tinkertoy—Mechanized Manufacture, Inspection and Assembly 3-81

Electrical materials
Early Research on Grain-Oriented Electrical Sheet, by W. B. Lockwood *(c)* 5-128
Electrical Steel—A Triumph of Steelmaking, Heat Treatment and Scientific Metallurgy, by William Jones 2-70
Ultra-Pure Metal *(d)* 4-196

Extrusion
Extruded Blades (Pictorial Story) 6-100

Fabrication
Economic Survey of Seven Methods of Making Small Machine Parts, by Samuel Storchheim 2-77

Fatigue
Effect of Shot-Peening Variables and Residual Stresses on Fatigue Life, by R. L. Mattson and W. S. Coleman, Jr. 5-108

Flame heat treatment
Flame Hardening of Heavy Forgings, by Stephen Smith 5-100

Forgings
Flame Hardening of Heavy Forgings, by Stephen Smith 5-100

Foundry
Controlling Metal Quality at Ford's Cleveland Foundry 2-87
Correction to Article on Ford Foundry, by E. L. Buchman *(c)* 5-128

***(br)* Book Review; *(c)* Correspondence; *(cp)* Critical Points; *(d)* Digest; *(ds)* Data Sheet; *(sr)* Short Runs.**

Fracture
Brittle Fracture as a Function of Grain Size, by N. J. Petch *(d)* 6-184

Furnaces
Carbon Restoration of Bar Stock With a Batch-Type Furnace, by H. W. Callahan 6-96
Furnace Insulation *(sr)* 3-108
Method for Improving Temperature Uniformity in Furnaces, by Otto Lutherer and Richard J. Reed 4-113

Galvanizing
The Effect of Chromate Films on the Corrosion Resistance of Hot Dip Galvanize in Brine, by Frank J. Bubsey 5-122

Ghosts
Bird in the Bush, by John Hutchins *(c)* 4-130

Grain size
Brittle Fracture as a Function of Grain Size, by N. J. Petch *(d)* 6-184

Hardenability
Hardenability Bands for Boron Steels *(ds)* 4-112B

Hardness tests
Wire Hardness Test, by Louis Small and G. Sevick 4-107

Heat, radiant
Inexpensive Heat Lamps for High Temperatures, by Carroll F. Powell *(d)* 6-186

Heat resisting alloys
American Developments in Alloys for High Temperatures, by C. L. Clark 1-72
Heat Resisting Alloys, by Tom Bishop *(c)* 1-124
Metallic Materials for a Steam Power Plant Operating at 1130° F., by H. Buchholtz, Wilhelm Ruttman and Rudolf Schinn 1-116
Steels for High Temperatures, by W. E. Bardgett and G. R. Bolsover *(d)* 6-154

Heat treatment
Carbon Restoration of Bar Stock With a Batch-Type Furnace, by H. W. Callahan 6-96
Protection of Hot Work Tools in Heat Treatment, by J. Y. Riedel 3-85

High speed steels
Introducing: The New Self-Lubricating High Speed Steels, by Stewart G. Fletcher 2-161

High-temperature properties
Basic Diagrams of Composition Vs. High-Temperature Strength, by I. I. Kornilov *(d)* 2-184

History
Materials for Large Army Gun Tubes —a History. Part I—Cast Iron, by Peter R. Kosting 5-90
Role of History in Evaluating Metals; Review by John R. Townsend of "History of Strength of Materials", by Stephen P. Timoshenko *(br)* 3-87

Inspection
Test Instruments Using Eddy-Current Principle, by William A. Cannon, Jr. *(d)* 3-134

Inspection, magnetic flux
Flaw Detection With Search Coils, by C. H. Hastings and G. A. Darcy *(d)* 5-162

Inspection, magnetic particle
Improved Tools Expedite Magnetic Particle and Penetrant Inspection, reported by Arthur H. Allen 1-161

Inspection, sonic
Portable Ultrasonic Instruments, by Peter K. Bloch 3-161
Ultrasonic Equipment for Thickness Measurement, by Peter K. Bloch *(d)* 2-194

Iron
Improved Method for Reduction of Iron Powders, by Heinrich Siepmann *(d)* 3-192

Light Metallurgy
The Cry of Tin, by R. P. Lister 5-98
The Rise and Fall of the Raines Law Sandwich, by Waldimir Anderson 2-84

Lubricants
Mold Lubricant *(sr)* 3-110

Magnapolish
Method for Revealing Hairline Cracks *(sr)* 3-109

Magnesium
Intracrystalline Voids in Magnesium Alloys, by E. Lardner *(d)* 3-182

Magnetic materials
Lodestones and Magnets *(cp)* 4-99

Materials
Industrial Progress Related to Available Materials, by Harold L. Maxwell *(d)* 5-148

Mechanical handling
Metallurgist Assesses Impact of New Automatic Control Mechanisms, by Arthur H. Allen 3-65
Project Tinkertoy—Mechanized Manufacture, Inspection and Assembly 3-81

Metallurgy, foreign
Advanced Practices in Italy, by Alberto Oreffice 1-84
British Advances in Metals, Fabrication Methods and Applications, by Tom Bishop 1-101
Current Russian Metallurgical Texts—IV, by Carl Andrew Zapffe 5-125
A Glimpse of European Metallurgy *(cp)* 1-66
Metallurgical Activities in Japan, by Daniel J. Murphy 1-67

Microradiography
Industrial Uses of Microradiography, by S. Goldspiel and F. Bernstein *(d)* 4-184

Molybdenum
Effective Heat Treatment of Molybenum, by T. G. Perry, H. S. Spacil and John Wulff 2-75

Nautilus
Launching of the Nautilus *(cp)* 3-79

Nicrobraz
Brazing *(sr)* 3-108

Nominating Committees
Nominating Committees for A.S.M. National Officers 4-100

Nonferrous metals
The Commercial Metals (Other than Iron); Review by Carl E. Swartz of "Modern Uses of Nonferrous Metals" *(br)* 6-125

Ordnance
Materials for Large Army Gun Tubes—a History. Part I—Cast Iron, by Peter R. Kosting 5-90
Materials for Large Army Gun Tubes—A History. Part II—Wrought Iron and Brass Cannon, by Peter R. Kosting 6-91

Painting
Surface Preparation of Steel for Painting, by Joseph Bigos 4-123

Parlanti process
Sound Castings by Controlling Heat Transfer, by C. A. Parlanti *(d)* 2-126

Patents
Comment on Patent Disclosures, T. J. Doran *(c)* 1-122

Phase diagrams
Basic Diagrams of Composition Vs. High-Temperature Strength, bp I. I. Kornilov *(d)* 2-184

Pipe (Defect)
Piping Causes Freak (but Perfect) Separation, by Henry J. Albert *(c)* 4-128

Plutonium
Metallurgy at Los Alamos, 1943-1945, by Cyril Stanley Smith 5-81

Powder metallurgy
Economic Survey of Seven Methods of Making Small Machine Parts, by Samuel Storchheim 2-77
Fabrication of Beryllium by Powder Metallurgy, by Wallace W. Beaver 4-92
Improved Method for Reduction of Iron Powders, by Heinrich Siepmann *(d)* 3-192
Properties of Sintered Nickel Steels, by F. Benesovsky *(d)* 4-200

Power plants
Metallic Materials for a Steam Power Plant Operating at 1130° F., by H. Buchholtz, Wilhelm Ruttman and Rudolf Schinn 1-116

Pure metals
Ultra-Pure Metal *(d)* 4-196

Quenching
Quench Cracks in Wrought Steel Tubes, by Cyril Wells 5-113

Radioactive materials
The New Radiometallurgy Laboratory at the Hanford Atomic Operation, by Thomas W. Gore 6-81

Razor blades
Sharpness Tester for Razor Blade, by Keizo Iwase *(c)* 3-112

Recrystallization
Recrystallization in Aluminum Alloys, by W. M. Williams and R. Eborall *(d)* 4-186

Refractory metals
"New" Materials by High Temperature; a Review by Roger A. Long of "Refractory Hard Metals", by Paul Schwarzkopf and Richard Kieffer *(br)* 2-86

Rolling
A Combination Mill for Experimental Rolling of the "New" Metals, by A. I. Nussbaum 4-121
Introduction to Directionality in Copper, by G. L. J. Bailey *(d)* 5-190

Salt baths
Line of Salt Baths Heat Treats 90-Mm. Gun Recoil Mechanism, by Glenn F. Hyde 5-104
Sulphurized Surfaces Resist Wear and Seizure, by Bernard Jousset 1-76

Sharpness
Sharpness Tester for Razor Blade, by Keizo Iwase *(c)* 3-112

Shot-peening
Effect of Shot-Peening Variables and Residual Stresses on Fatigue Life, by R. L. Mattson and W. S. Coleman, Jr. 5-108

Sigma phase
Sigma—an Unwanted Constituent in Stainless Weld Metal, by Lorin K. Poole 6-108

Size measurement
Ultrasonic Equipment for Thickness Measurement, by Peter K. Bloch *(d)* 2-194

Specifications
Aluminum Alloys for Permanent Mold and Die Casting, Compiled by H. S. Jerabek and F. M. Howell *(ds)* 5-112B
Correction to Data Sheet on Wrought Al Alloys, by F. M. Howell *(c)* 1-122
Standard Analyses of German Alloy Steels *(ds)* 1-96B
Wrought Aluminum Alloys—Compositions, Properties, and Designations; Compiled by F. M. Howell and H. S. Jerabek *(ds)* 6-112B

Spectroscopy
Controlling Metal Quality at Ford's Cleveland Foundry 2-87
Correction to Article on Ford Foundry, by E. L. Buchman *(c)* 5-128

Stainless steels
1916 Production of Stainless in Norway *(sr)* 3-109
Casting Stainless Steel in Shell Molds, by H. J. Cooper and M. L. Katz 4-107
Modern Stainless Steels, by Robert H. Aborn 6-117
Norwegian Production of Stainless Steels, by John Sissener 1-81
Sigma—an Unwanted Constituent in Stainless Weld Metal, by Lorin K. Poole 6-108
Welded Joints in Stainless Equipment *(cp)* 3-79

Statistical Control
Detecting Troubles, by Paul S. Olmstead *(d)* 4-178

Steelmaking
Advantages of Silicon Capping, by Albert Lami *(d)* 2-142
Comparison of Costs in Openhearth and Electric Furnace Shops, by S. L. Case, D. D. Moore, C. E. Sims and R. J. Lund *(d)* 6-174
Economics of Openhearth and Electric Furnaces, by L. F. Reinartz and H. C. Barnes *(d)* 5-174
New Manufacturing Processes for High-Grade Steels in Sweden, by Bo Kalling 1-108
Silicon Monoxide Reactions in Steelmaking, by N. C. Tombs and A. J. E. Welch *(d)* 6-188

Steelmaking, bessemer
Evolution of the Thomas (Basic Bessemer) Steel-making Process in Europe, by G. Husson 1-94
Scale Additions Reduce Phosphorus and Nitrogen in Basic Bessemer Steel, by W. A. Smith *(d)* 6-146

Steels, alloy
Developments in German Constructional Steels to Conserve Scarce Alloys, by F. W. Bruhl 1-97
Standard Analyses of German Alloy Steels *(ds)* 1-96B

Steels, boron
Deboronization of Steels, by J. C. Shyne and E. R. Morgan 6-88
German Investigations on Boron Steels, by Robert Scherer and Karl Bungardt 3-101
Hardenability Bands for Boron Steels *(ds)* 4-112B
Overheating of Boron Steel, by M. H. Pakkala and C. W. Spicer *(c)* 1-122

(*br*) Book Review; (*c*) Correspondence; (*cp*) Critical Points; (*d*) Digest; (*ds*) Data Sheet; (*sr*) Short Runs.

Steels, nickel
Properties of Sintered Nickel Steels, by F. Benesovsky *(d)* 4-200

Steels, silicon
Early Research on Grain-Oriented Electrical Sheet, by W. B. Lockwood *(c)* 5-128
Electrical Steel—a Triumph of Steelmaking, Heat Treatment and Scientific Metallurgy, by William Jones 2-70

Strain markings
Strain Markings in Aluminum Alloys, by W. H. L. Hooper *(d)* 6-166

Strength
Role of History in Evaluating Metals; Review by John R. Townsend of "History of Strength of Materials", by Stephen P. Timoshenko *(br)* 3-87

Stress-corrosion
Testing the Tendency to Stress-Corrosion Cracking, by Wilhelm Rädeker *(d)* 3-140
Transgranular Stress-Corrosion, by C. Edeleanu *(d)* 6-178

Sulphurizing
Sulphurized Surfaces Resist Wear and Seizure, by Bernard Jousset 1-76

Temperature
Method for Improving Temperature Uniformity in Furnaces, by Otto Lutherer and Richard J. Reed 4-113

Tension test
Effects of Loading and Straining Rates on the Stress-Strain Curve, by N. Krupnik and Hugh Ford *(d)* 5-168
Yield Phenomena of Aluminum Alloys, by V. A. Phillips *(d)* 5-200

Thermocouples
Design and Construction of Needle Thermocouples, by W. Gerard Rauch .. 3-71
Open-Circuit Couples, by C. J. Thwaites *(c)* 3-114

Tin
The Cry of Tin, by R. P. Vister 5-98

Titanium
Castings *(sr)* 3-110
Frictional Properties of Titanium and Its Alloys, by E. Rabinowicz 2-107
Surface Hardening Processes for Titanium and Its Alloys, by R. W. Hanzel 3-89
Titanium in 1953, by James R. Long 1-105
Welding of Binary Titanium Alloys, by G. E. Faulkner, G. B. Grable and C. B. Voldrich *(d)* 6-170

Titanium, metallography
Credit Where It Is Due, by Lee S. Busch *(c)* 2-112
"Aircraft Quality", by A. F. Sprankle *(c)* 6-128
Paul Richard Kuehnrich, English Toolsteel Metallurgist, by Alan Torry *(c)* .. 6-128

Toolsteels
The Quality of Toolsteel—Historical Development, by Burns George 2-97
The Quality of Toolsteel—Recent Developments and Future Predictions, by Burns George 3-75
Protection of Hot Work Tools in Heat Treatment, by J. Y. Riedel 3-85

Tubemaking
High-Speed Mill Forms, Induction Welds and Sizes Thin-Gage Nonferrous Tubing, by Thomas J. Crawford 2-65

Uranium
Metallurgy at Los Alamos, 1943-1945, by Cyril Stanley Smith 5-81

Vacuum refining
Furnace Insulation *(sr)* 3-108

Vanadium
Oxygen in Iron-Vanadium Melts, by R. A. Karasev, A. Yu. Polyakov and A. M. Samarin *(d)* 3-178

Wear
Report of Symposium on Wear and Abrasion *(d)* 6-162
Sulphurized Surfaces Resist Wear and Seizure, by Bernard Jousset 1-76

Weldability
Supplement on Weldability 1-192
Weldability of Steel as It Is Considered by Swiss Engineers, by Charles G. Keel 1-89
Weldability Shown by Dilatation Tests, by C. L. M. Cottrell *(d)* 5-158

Welding
Cone-Arc Welding, by P. Patriarca and G. M. Slaughter *(d)* 5-194
Metallurgical Impasse in Welding Nodular Irons, by Edward E. Hucke and Harry Udin *(d)* 2-174
Welded Joints in Stainless Equipment *(cp)* 3-79
Welding of Binary Titanium Alloys, by G. E. Faulkner, G. B. Grable and C. B. Voldrich *(d)* 6-170

Wire
Wire Hardness Test, by Louis Small and G. Sevick 4-107

Wiredrawing
Effect of Elevated Temperatures on Drawing Operations, by F. C. Thompson, J. B. Carroll and E. Benitt *(d)* .. 2-130

Zinc
Intercrystalline Corrosion of Zinc-Aluminum Alloys, by C. W. Roberts *(d)* 5-154

Zirconium
Claims Statement on Zr Alloys Is Contrary to General Rule, by S. T. Quass *(c)* 2-112
Endurance Limit of Zirconium, by W. P. Wallace and R. H. Wallace *(c)* 4-128
Statement on Zr Alloys Not Meant to Be Revolutionary, by Earl T. Hayes *(c)* 2-114

Author Index

Aborn, Robert H. 6-117
Aitchison, Leslie *(br)* 4-98
Albert, Henry J. *(c)* 4-128
Allen, Arthur H. 1-161; 3-65
Anderson, Waldimir 2-84
Bailey, G. L. J. *(d)* 5-190
Bardgett, W. E. *(d)* 6-154
Barnes, H. C. *(d)* 5-174
Beaver, Wallace W. 4-92
Benesovsky, F. *(d)* 4-200
Benitt, E. *(d)* 2-130
Bernstein, F. *(d)* 4-184
Bigos, Joseph 4-123
Bishop, Tom ..... 1-101; *(c)* 1-124; *(c)* 2-112
Bloch, Peter K. *(d)* 2-194; 3-161
Bolsover, G. R. *(d)* 6-154
Bornemann, Alfred ..... 3-97; *(da)* 3-96B
Brandes, E. A. *(d)* 2-208
Brenner, Paul 1-112
Bruhl, F. W. 1-97
Bubsey, Frank J. 5-122
Buchman, E. L. *(c)* 5-128
Buchholtz, H. 1-116
Bungardt, Karl 3-101
Busch, Lee S. *(c)* 2-112
Callahan, H. W. 6-96
Cannon, William A., Jr. *(d)* 3-134
Case, S. L. *(d)* 6-174
Carroll, J. B. *(d)* 2-130
Clark, C. L. 1-72
Coleman, W. S., Jr. 5-108
Cooper, H. J. 4-107
Cottrell, C. L. M. *(d)* 5-158
Crawford, Thomas J. 2-65
Curtis, C. E. *(d)* 3-198
Darcy, G. A. *(d)* 5-162
Dennison, J. P. *(d)* 2-138
Dohrmann, R. R. *(d)* 2-196
Doran, T. J. *(c)* 1-122
Eborall, R. ..... *(d)* 3-136; *(d)* 3-196; *(d)* 4-156
Edeleanu, C. *(d)* 6-178
Faulkner, G. E. *(d)* 6-170
Fine, M. E. *(d)* 5-184
Fletcher, Stewart G. 2-161
Ford, Hugh *(d)* 5-168
George, Burns 2-97; 3-75
Goldspiel, S. *(d)* 4-184
Gore, Thomas W. 6-81
Grable, G. B. *(d)* 6-170
Griffith, Robert F. 4-81
Hanzel, R. W. 3-89
Hastings, C. H. *(d)* 5-162
Hayes, Earl T. *(c)* 2-114
Hedman, Edward A. *(d)* 5-182
Hooper, W. H. L. *(d)* 6-166
Hopkins, B. E. *(d)* 2-178
Howell, F. M. *(c)* ..... 1-122; *(da)* 5-112B; *(da)* 6-112B
Hucke, Edward E. *(d)* 2-174
Hurst, H. J. *(d)* 1-138
Husson, G. 1-94
Hutchins, John *(c)* 4-130
Hyde, Glenn F. 5-104
Iwase, Keizo *(c)* 3-112
Jerabek, H. S. *(da)* ..... 5-112B; *(da)* 6-112B
Jones, William 2-70
Jousset, Bernard 1-76
Kalling, Bo 1-108
Karasev, R. A. *(d)* 3-178
Katz, M. L. 4-107
Keel, Charles G. 1-89
Klas, Heinrich *(d)* 1-142
Koebel, Norbert K. ..... 2-90; *(da)* 2-96B
Kondic, Voya *(br)* 4-98
Kornilov, I. I. *(d)* 2-184
Kosting, Peter R. 5-90; 6-91
Krupnik, N. *(d)* 5-168
Lami, Albert *(d)* 2-142
Lardner, E. *(d)* 3-182
Lister, R. P. 5-98
Lockwood, W. B. *(c)* 5-128
Long, James R. 1-105
Long, Roger A. *(br)* 2-86
Lund, R. J. *(d)* 6-174
Lutherer, Otto 4-113
Malcor, H. *(d)* 4-190
Mantle, E. C. *(d)* 3-186
Mattson, R. L. 5-108
Maxwell, Harold L. *(d)* 5-148
May, R. *(d)* 5-164
Miller, Arnold *(d)* 5-182
Mitchell, K. W. *(d)* 2-208
Moore, D. D. *(d)* 6-174
Morgan, E. R. 6-88
Murphy, Daniel J. 1-67
Murray, Thomas E. 3-107
Nussbaum, A. I. 4-121
Olmstead, Paul S. *(d)* 4-178
Oreffice, Alberto 1-84
Pahler, Robert E. 4-86
Pakkala, M. H. *(c)* 1-122
Parlanti, C. A. *(d)* 2-126
Patriarca, P. *(d)* 5-194
Perry, T. G. 2-75
Petch, N. J. *(d)* 6-184
Phillips, V. A. *(d)* 5-200
Polyakov, A. Yu. *(d)* 3-178
Poole, Lorin K. 6-108
Powell, Carroll F. *(d)* 6-186
Preece, A. *(d)* 2-138
Quaass, S. T. *(c)* 2-112
Rabinowicz, E. 2-107
Rädeker, Wilhelm *(d)* 3-140
Rauch, W. Gerard 3-71
Read, W. T., Jr. 2-101
Reed, Richard J. 4-113
Rees, W. P. *(d)* 2-178
Reinartz, L. F. *(d)* 5-174
Riedel, J. Y. 3-85
Roberts, C. W. *(d)* 5-154
Ruttman, Wilhelm 1-116
Samarin, A. M. *(d)* 3-178
Scherer, Robert 3-101
Schinn, Rudolf 1-116
Schwartz, M. A. *(d)* 3-198
Sevick, G. 4-107
Shatalov, A. Ya. *(d)* 4-174
Shaw, Arthur B. *(d)* 2-185
Shyne, J. C. 6-88
Siepmann, Heinrich *(d)* 3-192
Sims, C. E. *(d)* 6-174
Sissener, John 1-81
Slaughter, G. M. *(d)* 5-194
Small, Louis 4-107
Smith, Cyril Stanley 5-81
Smith, F. J. M. *(d)* 6-156
Smith, Stephen 5-100
Smith, W. A. *(d)* 6-146
Spacil, H. S. 2-75
Spicer, C. W. *(c)* 1-122
Sprankle, A. F. *(c)* 6-128
Staples, R. T. *(d)* 1-138
Stine, Victor F. 6-104
Storchheim, Samuel 2-77
Sully, A. H. *(d)* 2-208
Swain, A. J. *(d)* 3-196
Swartz, Carl E. *(br)* 6-125
Sykes, J. *(d)* 2-186
Thompson, F. C. *(d)* 2-130
Thwaites, C. J. *(c)* 3-114
Tombs, N. C. *(d)* 6-188
Timoshenko, Stephen P. *(br)* 3-87
Torry, Alan *(c)* 6-128
Udin, Harry *(d)* 2-174
Voldrich, C. B. *(d)* 6-170
Wallace, R. H. *(c)* 4-128
Wallace, W. P. *(c)* 4-128
Weiss, Myron 2-82
Welch, A. J. E. *(d)* 6-188
Wells, Cyril 5-113
White, G. D. *(d)* 3-198
Williams, W. M. *(d)* ..... 3-136; *(d)* 4-156
Wulff, John 2-75
Wyman, L. L. *(d)* 2-202
Zapffe, Carl Andrew 5-125

(*br*) Book Review; (*c*) Correspondence; (*cp*) Critical Points; (*d*) Digest; (*ds*) Data Sheet; (*sr*) Short Runs.

Metal Progress

VOLUME 66—JULY TO DECEMBER 1954

METAL PROGRESS IS OWNED, PUBLISHED AND COPYRIGHTED BY

THE AMERICAN SOCIETY FOR METALS

7301 Euclid Avenue, Cleveland 3, Ohio

The American Society for Metals is not responsible for statements or opinions printed in this publication.

Subject Index

The subject headings used in this index are chosen in accordance with the ASM-SLA Metallurgical Literature Classification, published by the American Society for Metals, 1950. The Metals Handbook committee reports published in Vol 66, No. 1A (July 15, 1954), are separately indexed in that issue starting on p. 173.

Aging
Strain-Aging of Mild Steel Strip, by B. Jones and R. A. Owen-Barnett *(d)* ... 5-180

Aircraft
Castings for Aircraft, by Lon C. Kappel *(d)* ... 3-152
Jet Engines, by E. E. Thum *(br)* ... 3-96

Alchemy
Metallurgy in the Days of Alchemy, by Carl Andrew Zapffe ... 3-89

Aluminum
Aluminum in France, by T. L. Fritzlen ... 3-113
Australia's Memorial to U.S.A., by Tom Bishop *(c)* ... 1-122
Coatings *(sr)* ... 6-120
Hard Coatings for Aluminum Alloys, by F. J. Gillig *(d)* ... 5-162
Heat Treating *(sr)* ... 6-120
In-Process Machining of Large Aluminum Forgings, by Alfred H. Petersen ... 2-81
Monograph on Aluminum, by Frank G. Norris *(br)* ... 1-106
New Numbering System for Wrought Aluminum Alloys *(ds)* ... 3-112B
Painting of Aluminum and Magnesium, by Robert I. Wray ... 6-121
Phase Relationships in the Al-V Alloy System, by D. J. Kenney, O. N. Carlson and H. A. Wilhelm *(d)* ... 4-161
Properties of Al-Mg-Si Alloys Containing Iron, Manganese or Chromium, by R. Chadwick, N. B. Muir and H. B. Grainger *(d)* ... 1-178
Protective Behavior of Paint Primers, by E. W. Skerrey and J. D. Rigg *(d)* ... 1A-A193
Retention of Metal by Melting Flux, by A. W. Sully, H. K. Hardy and T. J. Hes *(d)* ... 2-160
Stretcher-Strain Marks in Al-Mg Alloys, by A. J. Swain, V. A. Phillips and R. Eborall *(d)* ... 1A-A188
Time-Temperature Parameters for Creep and Rupture of Aluminum, by George J. Heimerl *(d)* ... 6-168
Zirconium Additions Inhibit Grain Growth in Extruded Al by M. Scheidecker and J. Herenguel *(d)* ... 3-188

American Society for Metals
The A.S.M. of Tomorrow, by William H. Eisenman ... 6-80
George A. Roberts, President, American Society for Metals ... 6-106

Anodizing
Coatings *(sr)* ... 6-120
Hard Coatings for Aluminum Alloys, by F. J. Gillig *(d)* ... 5-162

Atomic energy
Atomic Energy Act of 1954 ... 6-110
A.E.C. Program for Power Development ... 1-97
An International Atomic Agency ... 5-124

Austempering
The Control of Mechanical Properties in Austempering, by Otto Schaaber *(d)* ... 5-187

Austenite decomposition
The Control of Mechanical Properties in Austempering, by Otto Schaaber *(d)* ... 5-187
Deformation-Induced Martensite in Austenitic Stainless, by B. L. Averbach, H. C. Fiedler and Morris Cohen *(d)* ... 4-184
Effect of Tensile Stress on Isothermal Transformation, by Subrata Bhattacharyya and George L. Kehl *(d)* ... 4-236
Magnetic Detector for Transformation Determinations, by R. D. Chapman and W. E. Jominy *(d)* ... 4-166
Transformation During Welding, by R. P. Dunphy, W. R. Apblett, Jr. and W. S. Pellini *(d)* ... 2-162

Australian memorial
Australia's Memorial to U.S.A., by Tom Bishop *(c)* ... 1-122

Barn
Barn Now Too Long *(c)* ... 4-145
Correction to Pahler Article; Barn Too Big, by Robert S. Burpo, Jr. *(c)* ... 2-122

Bearings
Selecting Metals for Oil-Film Bearings, by E. B. Etchells *(d)* ... 2-152
Sleeve-Bearing Alloys Susceptible to Cavitation Damage, by R. A. Schaefer, J. F. Cerness and H. A. Thomas *(d)* ... 2-170

Brass
Modern Trends in Brasses, by Arthur H. Allen ... 2-106

Brazing
Titanium Silver Brazed Under Inert Gas, by Harian L. Meredith *(d)* ... 6-196

Brittleness
Brittle Failure of Steel Structures—a Brief History, by M. E. Shank ... 3-83
Brittle Failure of Steel Structures—Factors of Importance, by M. E. Shank ... 4-120
Hydrogen Embrittlement of a Titanium Alloy, by Major R. J. Kotfila and Lt. E. F. Erbin ... 4-128
Welding, Metallurgy and Design in British Shipbuilding, by R. B. Shepheard *(d)* ... 3-180

Carbides
Fatigue Properties of Lamellar and Spheroidal Carbides, by G. E. Dieter, R. F. Mehl and G. T. Horne *(d)* ... 4-220

Carbo-nitriding
Carbo-Nitriding, by Harold N. Ipsen ... 5-119
Corrosion Resistance of Carbo-Nitrided Steel, by P. A. Clarkin and M. B. Bever ... 6-108

Carburizing
Elements of Gas Carburizing, by Walter Holcroft ... 5-106
Liquid Carburizing, by Thomas M. Dougherty ... 2-89

Cast iron
Quality of Cast Iron, by F. P. Gilligan *(c)* ... 2-120

Cast iron, nodular
Arc Welding of Nodular Irons, by C. L. Hoobler *(c)* ... 1-124
Formation of Graphite Nodules, by Albert De Sy *(nb)* ... 1-92

(*br*) Book Review; (*c*) Correspondence; (*cp*) Critical Points; (*d*) Digest; (*ds*) Data Sheet; (*lm*) Light Metallurgy; (*nb*) Notebook; (*sr*) Short Runs.

Cast iron, nodular (cont.)

Induction Surface Hardening of Ductile Iron, by Joseph C. Danko and Joseph F. Libsch 3-115
Mechanical Properties of Ductile Irons at Elevated Temperatures, by C. R. Wilks, N. A. Matthews and R. W. Kraft, Jr. *(d)* 4-206
A Problem in Nomenclature *(cp)* 4-114
Secondary Graphite in Ductile Iron, by J. C. Danko and J. F. Libsch *(d)* 4-214
Techniques Refined for Arc Welding Nodular Irons, by T. E. Kihlgren, H. C. Waugh, E. E. Hucke and H. Udin *(d)* 1-150

Casting

Castings for Aircraft, by Lon C. Kappel *(d)* 3-152
Denseners Improve Casting Quality *(d)* 5-198

Casting, continuous

Canadian Stainless Steel Mill *(cp)* 5-79
Continuous Melting and Casting—Bit by Bit *(cp)* 6-81

Cavitation

Sleeve-Bearing Alloys Susceptible to Cavitation Damage, by J. F. Cerness, R. A. Schaefer and H. A. Thomas *(d)* 2-170

Cerium

Solubility of Cerium in Alpha and Gamma Iron, by James O. Jepson and Pol Duwez *(d)* 4-188

Chem milling

Skin Milling by Chemical Solution, by Manuel C. Sanz 4-141

Chi phase

Laves and Chi Phases, by F. L. Ver-Snyder and H. J. Beattie, Jr. *(d)* 4-250

Cobalt

Effect of Heat Treatment on Behavior of a Cobalt-Base Alloy, by J. W. Weeton and R. A. Signorelli *(d)* 4-215

Cold treatment

Scope of Application for Subzero Treatments, by H. T. Gregg, Jr. *(d)* 3-174

Comparator

Inspection *(sr)* 2-112

Controlled atmospheres

Atmosphere Analysis and Control, by Wayne L. Besselman 5-102
Automatic Carbon Control, by Harold Ipsen and Edward J. Rupert 1-98
Carbo-Nitriding, by Harold N. Ipsen 5-119
Dew-Point Control in Practice, by O. E. Cullen 5-114
Dissociated Ammonia, by M. Robert Ogle 5-99
Dry Nitrogen as a Base for Prepared Atmospheres, by Donald Beggs 5-94
Elements of Gas Carburizing, by Walter Holcroft 5-106
Endothermic Atmosphere, by Ralph J. Perrine 5-89
Equilibrium Relationships for Dew Point Control, by Norbert K. Koebel 5-110
Exothermic Atmospheres—Their Generation and Application, by W. H. Boyd 5-86
Neutral Heat Treating, by A. W. Frank 5-121
Safe Handling of Atmosphere Furnaces *(ds)* 5-112B
Sintering, by Carl G. Paulson 5-122
Theory of Gas Atmospheres, by A. G. Hotchkiss 5-81

Copper

Improved Anodes for Acid Copper Plating, by R. P. Nevers, R. L. Hungerford and E. W. Palmer *(d)* 5-156
New Cu-Mn-Sn Alloys, by J. W. Guthbertson and J. C. Blade *(d)* 2-136
Nitrogen-Arc Welding of Copper Promises Economies, by E. Davis, C. A. Terry and K. Winterton *(d)* 4-256
Pitting Corrosion of Copper Alloys, by R. May *(d)* 2-176

Copper-gold system

Transformation of Ordered Structures, by W. E. Bond, F. N. Rhines and R. A. Rummel *(d)* 4-199

Corrosion

Air-Corrosion of Fe-Ni-Cr Alloys, by Anton deS. Brasunas *(ds)* 6-112B
Causes of Filiform Corrosion, by M. Van Loo, D. D. Laiderman and R. R. Bruhn *(d)* 1A-A150
Corrosion of Pump Parts, by Edward H. Huss 2-100
Corrosion Resistance of Carbo-Nitrided Steel, by P. A. Clarkin and M. B. Bever 6-108
Tests for Corrosion Resistance of Galvanized Wire, by Jean Herenguel *(d)* 6-172

Corrosion tests

Evaluate Oxalic Acid Etching Test, by M. A. Streicher *(d)* 1A-A176
Screening Test for Cast Stainless Steels, by G. W. Jackson and W. A. Luce *(d)* 1-166

Creep

Materials for 1000° C. (1832° F.), by N. P. Allen *(d)* 6-180
Phase Changes During Creep-Rupture Test, by E. C. Roberts, N. J. Grant and Morris Cohen *(d)* 4-240
Time-Temperature Parameters for Creep and Rupture of Aluminum, by George J. Heimerl *(d)* 6-168

Cutting tools

Alumina-Tipped Cutters, by K. J. B. Wolfe *(d)* 2-143

Damping

Influence of Static Stress on Damping Capacity, by A. W. Cochardt *(d)* 4-210

Dendritic growth

Controlling Factor for Dendritic Growth, by W. Morris, W. A. Tiller, J. W. Rutter and W. C. Winegard *(d)* 4-228

Deoxidation

Deoxidation of Iron by Silicon, by E. Ll. Evans and H. A. Sloman *(d)* 1A-A182
Studies Reveal Purity of Steel Deoxidized With Titanium, by E. L. Evans and H. A. Sloman *(d)* 6-164

Education

Metallurgy Needs a Huckster, by R. M. Brick *(c)* 2-122

Electroplating

Automatic Zinc Plating, by C. E. Fisher and D. F. Zlatnik 3-107
Improved Anodes for Acid Copper Plating, by R. P. Nevers, R. L. Hungerford and E. W. Palmer *(d)* 5-156
Kanigen Nickel Plating, by Gregoire Gutzeit 1-113
Nickel Plating From Sulphamate Baths, by Myron B. Diggin 4-132

Enameling

Vitreous Enameling Keeps Pace With Production Practices, by Wilbur H. Pfeiffer *(d)* 3-146

Etching

Cathodic Vacuum Etching, by T. R. Padden and F. M. Cain, Jr. 1-108

Extrusion

Quality of Extrusions, by Christopher Smith and N. Swindells *(d)* 1A-A170
60-Cycle Induction Heating for Forging and Extrusion, by John A. Logan 6-94
Zirconium Additions Inhibit Grain Growth in Extruded Al, by J. Herenguel and M. Scheidecker *(d)* 3-188

Fasteners

Thread Inserts of 18-8 Stainless for Magnesium Components, by Paul E. Wolfe *(d)* 1-184

Fatigue

Concerning the Endurance Limit of Zirconium, by J. J. Kearns and F. Forscher *(c)* 4-145
Fatigue, by R. P. Lister *(lm)* 1-91
Fatigue Properties of Lamellar and Spheroidal Carbides, by G. E. Dieter, R. F. Mehl and G. T. Horne *(d)* 4-220
Mechanism of Fatigue Failure, by N. H. Polakowski and A. Palchoudhuri *(d)* 5-196

Fluxes

Retention of Metal by Melting Flux, by H. K. Hardy, A. H. Sully and T. J. Heal *(d)* 2-160

Forging

60-Cycle Induction Heating for Forging and Extrusion, by John A. Logan 6-94
The Case for High Frequency, by Frank T. Chesnut 6-98
Dual-Frequency Heating for Hot Forging, by Carl P. Bernhardt 6-102
Heavy Presses Near Completion, by Arthur H. Allen 1-81
Induction Heat, by Frank T. Chesnut 6-91

Forgings

Internal Stresses in Forgings Minimized With Slow Cooling, by C. Sykes *(d)* 3-164
In-Process Machining of Large Aluminum Forgings, by Alfred H. Petersen 2-81
Manufacture of Large Forgings, by A. O. Schaefer *(d)* 1-148

Fracture

Brittle Failure of Steel Structures—a Brief History, by M. E. Shank 3-83
Brittle Failure of Steel Structures—Factors of Importance, by M. E. Shank 4-120
Failure of Structural Sections in Welded Ships, by M. L. Williams and G. A. Ellinger *(d)* 1A-A156
The Notched Slow-Bend Test, by J. E. de Graaf and J. H. van der Veen *(d)* 1A-A139

Gases

Seminar on Gas-Metal Phenomena, by Carl A. Zapffe *(br)* 4-127

Ghosts

Not What It's Cracked Up to Be, by Welton J. Crook *(c)* 4-145

Graphitization

Formation of Graphite Nodules, by Albert De Sy *(nb)* 1-92
Secondary Graphite in Ductile Iron, by J. C. Danko and J. F. Libsch *(d)* 4-214

Grinding

Grinding Cemented Carbides, a Review by Arthur H. Allen 6-115
Grinding Damage to Hardened Steel, by W. Littman and J. Wulff *(d)* 4-246

Hardenability

Dependence of Microstructure on Hardenability, by S. T. Ross, R. T. Sernka and W. E. Jominy *(d)* 4-172
A Method for Calculating Hardenability, by C. F. Jatczak and R. W. Devine, Jr. *(d)* 4-176
A Method for Predicting Hardenability, by Neil J. Culp *(d)* 4-180
On "90% Martensite" and Answers to Inquiries, by R. A. Grange and H. H. Jackson *(c)* 2-121

Hardening

Improved Hardening Technique, by Eduard M. H. Lips, and H. Van Zuilen 2-103

Hardness

Effect of Carbon and Nitrogen on Martensite Hardness, by A. E. Nehrenberg, P. Payson and P. Lillys *(d)* 4-161

Heat

Thermos Battles *(d)* 6-156

Heat resisting alloys

Alloys for High Temperatures, by E. E. Fletcher, R. L. Beck, A. R. Elsea, A. B. Westerman and G. K. Manning *(d)* 1A-A191
Low-Alloy Ferritic Steels Checked for Turbine Wheel Service, by Arthur Zonder, Adron I. Rush and James W. Freeman *(d)* 5-202
Materials for 1000° C (1832° F.), by N. P. Allen *(d)* 6-180
Sigma Phase—a Review, by Adolph J. Lena 1-86

History

Metallurgy in the Days of Alchemy, by Carl Andrew Zapffe 3-89
The Saugus Ironworks 6-90

Induction heat

The Case for High Frequency, by Frank T. Chesnut 6-98
Dual-Frequency Heating for Hot Forging, by Carl P. Bernhardt 6-102
Induction Heat, by Frank T. Chesnut 6-91
Induction Heat Treating, by Harry P. Osborn, Jr. 5-125
Induction Heating Generators as Production Tools, by Peter A. Hassell 1-94
Induction Surface Hardening of Ductile Iron, by Joseph F. Libsch and Joseph C. Danko 3-115
Linings for Induction Furnaces, by H. E. White 3-99
60-Cycle Induction Heating for Forging and Extrusion, by John A. Logan 6-94

Inductive stirrer

Furnace Men Report on Advantages of Induction Stirrer *(d)* 2-140

Iron

Formation of Metallic Compounds of Iron, by I. I. Kornilov *(d)* 5-166

(*br*) Book Review; (*c*) Correspondence; (*cp*) Critical Points; (*d*) Digest; (*ds*) Data Sheet; (*lm*) Light Metallurgy; (*nb*) Notebook; (*sr*) Short Runs.

Iron (cont.)
Pelletizing Practices for Iron Ore, by Magnus Tigerschiöld *(d)* 6-150
The Saugus Ironworks 6-90
Solubility of Cerium in Alpha and Gamma Iron by Pol Duwez and James O. Jepson *(d)* 4-188
Some Factors Which Affect Quality of Iron Ore Sinters, by E. Cohen *(d)* 3-156

Literature techniques
Searching the Literature Automatically *(cp)* 6-82

Lubricants
Lubricants for Nonferrous Metalworking *(d)* 3-144

Machining
In-Processing Machining of Large Aluminum Forgings, by Alfred H. Petersen 2-81

Magnesium
Deformation in Magnesium, by F. E. Hauser, C. D. Starr, L. S. Tietz and J. E. Dorn *(d)* 4-168
A Mill for Magnesium Sheet *(cp)* 2-104
Painting of Aluminum and Magnesium, by Robert I. Wray 6-121
Protective Behavior of Paint Primers, by E. W. Skerrey and J. D. Rigg *(d)* 1A-A193
Stress-Corrosion in Magnesium, by F. H. Beck, D. K. Priest and M. G. Fontana *(d)* 4-190
Thread Inserts of 18-8 Stainless for Magnesium Components, by Paul E. Wolfe *(d)* 1-184

Martensite
On "90% Martensite" and Answers to Inquiries, by H. H. Jackson and R. A. Grange *(c)* 2-121
Strength of Low-Carbon Martensites, by C. C. Busby, M. F. Hawkes and H. W. Paxton *(d)* 4-196
X-Ray Mensurements of Lattice Distortions in Martensite, by V. A. Il'ina, V. K. Kritskaya and G. V. Kurdyumov *(d)* 1A-A154

Mechanical handing (of aluminum)
Heat Treating *(sr)* 6-120

Metallurgy
Physical Metallurgy Summarized, by Charles S. Barrett *(br)* 6-111

Microstructure
Dependence of Microstructure on Hardenability, by R. T. Sernka, S. T. Ross and W. E. Jominy *(d)* 4-172

Milling
Skin Milling by Chemical Solution, by Manuel G. Sanz 4-141

National Metal Congress
Consolidated Program, 36th National Metal Congress and National Metal Exposition 4-78
Technical Programs 4-81
What to See at the Metal Show, Exhibitors, Booth Numbers and Descriptions of Products in Ten Subject Categories 4-86

Nickel
Kanigen Nickel Plating, by Gregoire Gutzeit 1-113
Nickel Plating From Sulphamate Baths, by Myron B. Diggin 4-132

Nitrogen
Influence of Nitrogen in Cr-Mn-Ni Steels, by Russell Franks, W. O. Binder and James Thompson *(d)* 4-202

Ordered phase
Transformation of Ordered Structures, by F. N. Rhines, W. E. Bond and R. A. Rummel *(d)* 4-199

Ordnance
Quality of Cast Iron, by F. P. Gilligan *(c)* 2-120
Steel Cartridge Cases, by William N. King *(d)* 3-198

Painting
Adherence of Paint Films, by E. G. Bobalek 2-113
Painting of Aluminum and Magnesium, by Robert I. Wray 6-121
Protective Behavior of Paint Primers, by J. D. Rigg and E. W. Skerrey *(d)* 1A-A193

Pelletizing
Pelletizing Practices for Iron Ore, by Magnus Tigerschiöld *(d)* 6-150

Phase diagrams
Phase Equilibria in the Ti-Al-Mn System, by R. F. Domagala and W. Rostoker *(d)* 4-212
Phase Relationships in the Al-V Alloy System, by O. N. Carlson, D. J. Kenney and H. A. Wilhelm *(d)* 4-161
Solubility of Cerium in Alpha and Gamma Iron, by James O. Jepson and Pol Duwez *(d)* 4-188
Transformation of Ordered Structures, by F. N. Rhines, W. E. Bond and R. A. Rummel *(d)* 4-199

Pickling
Pickling *(sr)* 6-120

Pitting
Pitting Corrosion of Copper Alloys, by R. May *(d)* 2-176

Plastic deformation
Deformation in Magnesium, by C. D. Starr, F. E. Hauser, L. S. Tietz and J. E. Dorn *(d)* 4-168
Texture of Warm Rolled Steel, by C. Nusabaum and William Brenner, Jr. *(d)* 4-164

Polishing, metallographic
Metallography *(sr)* 2-111

Powder Metallurgy
Sintering, by Carl G. Paulson 5-122

Pressure vessels
British Tests on Welded Pressure Vessels, by Nicol Gross *(d)* 1-156
A New Steel for Pressure Vessels *(cp)* 3-82

Presswork
Heavy Presses Near Completion, by Arthur H. Allen 1-81

Rare earths
Rare Earths in Stainless Steels, by Howard O. Beaver 4-115

Rare metals
The Metallurgy of the Rarer Metals, by Bruce A. Rogers *(br)* 5-129

Refractories
Linings for Induction Furnaces, by H. E. White 3-99
Thermal Conductivity of Common Refractories *(da)* 4-112B

Research
Research in Canada, by Harold J. Roast 4-138
Research in the United States, by Georges Delhart *(d)* 3-194

Rolling
A Mill for Magnesium Sheet *(cp)* 2-104

Safety
Beware Explosions and Fires *(cp)* 5-80
Safe Handling of Atmosphere Furnaces *(da)* 5-112B

Salt baths
Liquid Carburizing, by Thomas M. Dougherty 2-89
Wartime Work on Bazooka Rockets, by George N. Vitt *(c)* 1-124

Scaling
Character of Oxide Scales on Titanium, by A. E. Jenkins *(d)* 3-172

Ships
Failure of Structural Sections in Welded Ships, by G. A. Ellinger and M. L. Williams *(d)* 1A-A156
Welding, Metallurgy and Design in British Shipbuilding, by R. B. Shepheard *(d)* 3-180

Sigma phase
Sigma Phase—a Review, by Adolph J. Lena 1-86; 2-94; 3-122

Sintering
Sintering, by Carl G. Paulson 5-122
Some Factors Which Affect Quality of Iron Ore Sinters, by E. Cohen *(d)* 3-156

Sorting
Inspection *(sr)* 2-112

Specifications
A.I.S.I. Standard Alloy Steel Compositions *(da)* 1-112B
A.I.S.I. Standard Boron Steel Compositions *(da)* 2-112B
New Numbering System for Wrought Aluminum Alloys *(da)* 3-112B
Specifications, French system *(sr)* 2-111

Springs
Inspection of Stainless Steel Spring Wire, by Alberto Oreffice *(c)* 2-120

Stainless steels
Air-Corrosion of Fe-Ni-Cr Alloys, by Anton deS. Brasunas *(da)* 6-112B
Aircraft Engine Valves, 1917, by Basil W. Doncaster *(c)* 1-122
Canadian Stainless Steel Mill *(cp)* 5-79
Deformation-Induced Martensite in Austenitic Stainless, by H. C. Fiedler, B. L. Averbach and Morris Cohen *(d)* 4-184
Effect of Sigma Phase on Properties of Alloys, by Adolph J. Lena 2-94
Influence of Nitrogen in Cr-Mn-Ni Steels, by Russell Franks, W. O. Binder and James Thompson *(d)* 4-202
Inspection of Stainless Steel Spring Wire, by Alberto Oreffice *(c)* 2-120
Rare Earths in Stainless Steels, by Howard O. Beaver 4-115
Screening Test for Cast Stainless Steels, by W. A. Luce and G. W. Jackson *(d)* 1-166
Sigma Phase—a Review, by Adolph J. Lena 1-86; 2-94; 3-122
Thread Inserts of 18-8 Stainless for Magnesium Components, by Paul E. Wolfe *(d)* 1-184

Statistical control
Mathematics in Quality Control, by Mario Parran *(d)* 1A-A166

Steelmaking
Monograph on Aluminum, by Frank G. Norris *(br)* 1-106
Studies Reveal Purity of Steel Deoxidized With Titanium, by E. L. Evans and H. A. Sloman *(d)* 6-164

Steelmaking, electric
Comparison of Costs in Openhearth and Electric Furnace Shops, by D. D. Moore, S. L. Case, C. E. Sims and R. J. Lund *(d)* 1-168
Comparison of Costs in Openhearth and Electric Furnace Shops, by S. L. Case, D. D. Moore, C. E. Sims and R. J. Lund *(d)* 2-146
Furnace Men Report on Advantages of Induction Stirrer *(d)* 2-140

Steelmaking, electric induction
Linings for Induction Furnaces, by H. E. White 3-99

Steelmaking, openhearth
Comparison of Costs in Openhearth and Electric Furnace Shops, by S. L. Case, D. D. Moore, C. E. Sims and R. J. Lund *(d)* 1-168
Comparison of Costs in Openhearth and Electric Furnace Shops, by D. D. Moore, S. L. Case, C. E. Sims and R. J. Lund *(d)* 2-146
Methane for Openhearth Fuel, by D. W. Gillings 2-91

Steels, alloy
A.I.S.I. Standard Alloy Steel Compositions *(da)* 1-112B

Steels, boron
A.I.S.I. Standard Boron Steel Compositions *(da)* 2-112B
A Low-Alloy, Cr-Mo-Ti-B Steel for Use up to 1200°F. 6-84

Steels, carbon
Our Commonest Metal and Its Problems, by John M. Parks *(br)* 2-118
Strain-Aging of Mild Steel Strip, by B. Jones and R. A. Owen-Barnett *(d)* 5-180

Steels, high-strength
Mechanical Properties of Weldable Vanadium Steels *(d)* 5-174
Replacement of Mo by V for High-Tensile Steels, by C. L. M. Cottrell and B. J. Bradstreet *(d)* 3-200

Steels, low-alloy
A Low-Alloy, Cr-Mo-Ti-B Steel for Use up to 1200°F. 6-84
A New Steel for Pressure Vessels *(cp)* 3-82

Steels, vanadium
Mechanical Properties of Weldable Vanadium Steels *(d)* 5-174

Strain markings
Stretcher-Strain Marks in Al-Mg Alloys, by V. A. Phillips, A. J. Swain and R. Eborall *(d)* 1A-A188

Stress-corrosion
Stress-Corrosion in Magnesium, by D. K. Priest, F. H. Beck and M. G. Fontana *(d)* 4-190
Stress-Corrosion Resisted by Additions of Ti and Ta-Cb, by E. Baerlecken and W. Hirsch *(d)* 1A-A140

Stresses
Internal Stresses in Forgings Minimized With Slow Cooling, by C. Sykes *(d)* 3-164

Tempering
Microstructural Changes in Fe-C Alloys, by B. S. Lement, B. L. Averbach and M. Cohen *(d)* 4-194

Titanium
Annealing of Titanium, by E. R. Funk 1-103
Character of Oxide Scales on Titanium, by A. E. Jenkins *(d)* 3-172
Commercial Feasibility of Titanium Castings, by R. F. Malone, H. T. Clark, S. V. Arnold and W. L. Finlay *(d)* 3-176
Hydrogen Embrittlement of a Titanium Alloy, by Lt. E. F. Erbin and Major R. J. Kotfila 4-128
Phase Equilibria in the Ti-Al-Mn System, by R. F. Domagala and W. Rostoker *(d)* 4-212
Special Techniques Used to Obtain Melting Point of Ti, by T. H. Schofield and A. E. Bacon *(d)* 5-184
Titanium Silver Brazed Under Inert Gas, by Harlan L. Meredith *(d)* 6-196

Toolsteels
A Method for Predicting Hardenability, by Neil J. Culp *(d)* 4-180
Toolsteel Mill in Canada *(cp)* 3-81

Tubing
Tubing Welded Faster With Less Power, by Donald P. Worden *(d)* 1A-A146

Turbines
Low-Alloy Ferritic Steels Check for Turbine Wheel Service, by Arthur Zonder, Adron I. Rush and James W. Freeman *(d)* 5-202

Vacuum refining
Some Advantages of Vacuum Melting and Casting, by J. D. Fast, A. I. Luteijn and E. Overbasch *(d)* 6-160
Vacuum Melting—Commercial and Experimental 6-113
Vacuum Melting—Semicontinuously *(cp)* 4-113

Valves
Aircraft Engine Valves, 1917, by Basil W. Doncaster *(c)* 1-122

Vanadium
Phase Relationships in the Al-V Alloy System, by H. A. Wilhelm, O. N. Carlson and D. J. Kenney *(d)* 4-161

Vitallium
Alloys for High Temperatures, by R. L. Beck, E. E. Fletcher, A. R. Elsea, A. B. Westerman and G. K. Manning *(d)* 1A-A191

Welding
Transformation During Welding, by W. R. Apblett, Jr., R. P. Dunphy and W. S. Pellini *(d)* 2-162
Welding, Metallurgy and Design in British Shipbuilding, by R. B. Shepheard *(d)* 3-180

Welding, arc
Arc Welding of Nodular Irons, by C. L. Hoobler *(c)* 1-124
He-N Shielding Gas Looks Promising in Metal-Arc Welding, by Eugene L. Turner and Walter F. Henler *(d)* 6-176
Nitrogen-Arc Welding of Copper Promises Economies, by E. Davis, C. A. Terry and K. Winterton *(d)* 4-256
Techniques Refined for Arc Welding Nodular Irons, by H. C. Waugh, T. E. Kihlgren, E. E. Hucke and H. Udin *(d)* 1-150

Welding, resistance
Conducting Primer for Resistance Welding, by A. J. Elleman and N. D. P. Smith *(d)* 5-168
Review of Problems in Resistance Welding Coated Steels, by J. E. Roberts *(d)* 3-162
Tubing Welded Faster With Less Power, by Donald P. Worden *(d)* 1A-A146

Wire
Tests for Corrosion Resistance of Galvanized Wire, by Jean Herenguel *(d)* 6-172

X-ray diffraction
X-Ray Measurements of Lattice Distortions in Martensite, by V. K. Kritskaya, V. A. Il'ina and G. V. Kurdyumov *(d)* 1A-A154

Zinc
Automatic Zinc Plating, by D. F. Zlatnik and C. E. Fisher 3-107

Zirconium
Concerning the Endurance Limit of Zirconium, by F. Forscher and J. J. Kearns *(c)* 4-145
Zirconium Additions Inhibit Grain Growth in Extruded Al, by J. Herenguel and M. Scheidecker *(d)* 3-188
Strength of Zirconium Binary Alloys at High Temperatures by H. A. Saller, J. T. Stacy and S. W. Porembka *(d)* 4-218
Strength of Zirconium at Moderate Temperatures, by J. H. Keeler *(d)* 4-182

Author Index

Allen, Arthur H. 1-81; 2-106; 6-115
Allen, N. P. *(d)* 6-180
Apblett, W. R., Jr. *(d)* 2-162
Arnold, S. V. *(d)* 3-176
Averbach, B. L. *(d)* 4-184, 4-194
Bacon, A. E. *(d)* 5-184
Baerlecken, E. *(d)* 1A-A140
Barrett, Charles S. *(br)* 6-111
Beattie, H. J., Jr. *(d)* 4-250
Beaver, Howard O. 4-115
Beck, F. H. *(d)* 4-190
Beck, R. L. *(d)* 1A-A191
Beggs, Donald 5-94
Bernhardt, Carl P. 6-102
Besselman, Wayne L. 5-102
Bever, M. B. 6-108
Bhattacharyya, Subrata *(d)* 4-236
Binder, W. O. *(d)* 4-202
Bishop, Tom *(c)* 1-122
Blade, J. C. *(d)* 2-136
Bobalek, E. G. 2-113
Bond, W. E. *(d)* 4-199
Boyd, W. H. 5-86
Bradstreet, B. J. *(d)* 3-200
Brasunas, Anton deS. *(ds)* 6-112a
Brenner, William, Jr. *(d)* 4-164
Brick, R. M. *(c)* 2-122
Bruhn, R. R. *(d)* 1A-A150
Burpo, Robert S., Jr. *(c)* 2-122
Busby, C. C. *(d)* 4-196
Cain, F. M., Jr. 1-108
Carlson, O. N. *(d)* 4-161
Case, S. L. *(br)* 1-106; *(d)* 1-168; *(d)* 2-146
Cerness, J. F. *(d)* 2-170
Chadwick, R. *(d)* 1-178
Chalmers, Bruce *(br)* 6-111
Chapman, R. D. *(d)* 4-166
Chesnut, Frank T. 6-91; 6-98
Clark, H. T. *(d)* 3-176
Clarkin, P. A. 6-108
Cochardt, A. W. *(d)* 4-210
Cohen, E. *(d)* 3-156
Cohen, Morris *(d)* 4-184, 4-194, 4-240
Cottrell, C. L. M. *(d)* 3-200
Crook, Welton J. *(c)* 4-145
Cullen, O. E. 5-114
Culp, Neil J. *(d)* 4-180
Cuthbertson, J. W. *(d)* 2-136
Danko, Joseph C. 3-115; *(d)* 4-214
Davis, E. *(d)* 4-256
de Graaf, J. E. *(d)* 1A-A139
Delbart, Georges *(d)* 3-194
De Sy, Albert *(nb)* 1-92
Devine, R. W., Jr. *(d)* 4-176
Dieter, G. E. *(d)* 4-220
Diggin, Myron B. 4-132
Domagala, R. F. *(d)* 4-212
Doncaster, Basil W. *(c)* 1-122
Dorn, J. E. *(d)* 4-168
Dougherty, Thomas M. 2-89
Dulles, John Foster 5-124
Dunphy, R. P. *(d)* 2-162
Duwez, Pol *(d)* 4-188
Eborall, R. *(d)* 1A-A188
Eisenman, William H. 6-80
Elleman, A. J. *(d)* 5-168
Ellinger, G. A. *(d)* 1A-A156
Elsea, A. R. *(d)* 1A-A191
Erbin, E. F. 4-128
Etchells, E. B. *(d)* 2-152
Evans, E. L. *(d)* 1A-A182; 6-164
Fast, J. D. *(d)* 6-160
Fiedler, H. C. *(d)* 4-184
Finlay, W. L. *(d)* 3-176
Fisher, C. E. 3-107
Fletcher, E. E. *(d)* 1A-A191
Fontana, M. G. *(d)* 4-190
Forscher, F. *(c)* 4-145
Frank, A. W. 5-121
Franks, Russell *(d)* 4-202
Freeman, James W. *(d)* 5-202
Fritzlen, T. L. 3-113
Funk, E. R. 1-103
Gillig, F. J. *(d)* 5-162
Gilligan, F. P. *(c)* 2-120
Gillings, D. W. 2-91
Grainger, H. B. *(d)* 1-178
Grange, R. A. *(c)* 2-121
Grant, N. J. *(d)* 4-240
Gross, Nicol *(d)* 1-156
Gutzeit, Gregoire 1-113
Hardy, H. K. *(d)* 2-166
Hassell, Peter A. 1-94
Hauser, F. E. *(d)* 4-168
Hawkes, M. F. *(d)* 4-196
Heal, T. J. *(d)* 2-160
Heimerl, George J. *(d)* 6-168
Henler, Walter F. *(d)* 6-176
Herenguel, J. *(d)* 3-188; 6-172
Hirsch, W. *(d)* 1A-A140
Holcroft, Walter 5-106
Hoobler, C. L. *(c)* 1-124
Horne, G. T. *(d)* 4-220
Hotchkiss, A. G. 5-81
Hungerford, R. L. *(d)* 5-156
Huss, Edward H. 2-100
Il'na, V. A. *(d)* 1A-A154
Ipsen, Harold 1-98; 5-119
Jackson, G. W. *(d)* 1-166
Jackson, H. H. *(c)* 2-121
Jatczak, C. F. *(d)* 4-176
Jenkins, A. E. *(d)* 3-172
Jepson, James O. *(d)* 4-188
Jominy, W. E. *(d)* 4-166; 4-172
Jones, B. *(d)* 5-180
Kappel, Lon C. *(d)* 3-152
Kearns, J. J. *(c)* 4-145
Keeler, J. H. *(d)* 4-182
Kehl, George L. *(d)* 4-236
Kenney, D. J. *(d)* 4-161
Kihlgren, T. E. *(d)* 1-150
King, William N. *(d)* 3-198
Koebel, Norbert K. 5-110
Kornilov, I. I. *(d)* 5-166
Kotfila, R. J. 4-128
Kraft, R. W., Jr. *(d)* 4-206
Kritskaya, V. K. *(d)* 1A-A154
Kurdyumov, G. V. *(d)* 1A-A154
Laiderman, D. D. *(d)* 1A-A150
Lement, B. S. *(d)* 4-194
Lena, Adolph J. 1-86; 2-94; 3-122
Libsch, Joseph F. 3-115; *(d)* 4-214
Lillys, P. *(d)* 4-161
Lips, Eduard M. H. 2-103
Lister, R. P. 1-91
Littman, Walter *(d)* 4-246
Logan, John A. 6-94
Longden, Edward *(d)* 5-198
Luce, W. A. *(d)* 1-166
Lund, R. J. *(d)* 1-168; 2-146
Luteijn, A. I. *(d)* 6-160
Malone, R. F. *(d)* 3-176
Manning, G. K. *(d)* 1A-A191
Matthews, N. A. *(d)* 4-206
May, R. *(d)* 2-176
Mehl, R. F. *(d)* 4-220
Meredith, Harlan L. *(d)* 6-196
Moore, D. D. *(d)* 1-168; 2-146
Morris, W. *(d)* 4-228
Muir, N. B. *(d)* 1-178
Nehrenberg, A. E. *(d)* 4-161
Nevers, R. P. *(d)* 5-156
Norris, Frank G. *(br)* 1-106
Nussbaum, C. *(d)* 4-164
Ogle, M. Robert 5-99
Oreffice, Alberto *(c)* 2-120
Osborn, Jr., Harry B. 5-125
Overbasch, E. *(d)* 6-160
Owen-Barnett, R. A. *(d)* 5-180
Padden, T. R. 1-108
Palchoudhuri, A. *(d)* 5-196
Palmer, E. W. *(d)* 5-156
Parks, John M. *(br)* 2-118
Parran, Mario *(d)* 1A-A166
Paulson, Carl G. 5-122
Paxton, H. W. *(d)* 4-196
Payson, P. *(d)* 4-161
Pellini, W. S. *(d)* 2-162
Perrine, Ralph J. 5-89
Petersen, Alfred H. 2-81
Pfeiffer, Wilbur H. *(d)* 3-146
Phillips, V. A. *(d)* 1A-A188
Polakowski, N. H. *(d)* 5-196
Porembka, S. W. *(d)* 4-218
Priest, D. K. *(d)* 4-190
Rhines, F. N. *(d)* 4-199
Rigg, J. D. *(d)* 1A-A193
Roast, Harold J. 4-138
Roberts, E. C. *(d)* 4-240
Roberts, J. E. *(d)* 3-162
Rogers, Bruce A. *(br)* 5-129
Ross, S. T. *(d)* 4-172
Rostoker, W. *(d)* 4-212
Rummel, R. A. *(d)* 4-199
Rupert, Edward J. 1-98
Rush, Adron I. *(d)* 5-202
Rutter, J. W. *(d)* 4-228
Saller, H. A. *(d)* 4-218
Sanz, Manuel C. 4-141
Schnaber, Otto *(d)* 5-187
Schaefer, A. O. *(d)* 1-148
Schaefer, R. A. *(d)* 2-170
Scheidecker, M. *(d)* 3-188
Schofield, T. H. *(d)* 5-184
Sernka, R. T. *(d)* 4-172
Shank, M. E. 3-83; 4-120
Shepheard, R. B. *(d)* 3-180
Signorelli, R. A. *(d)* 4-215
Sims, C. E. *(d)* 1-168; 2-146
Skerrey, E. W. *(d)* 1A-A193
Sloman, H. A. *(d)* 1A-A182; 6-164
Smith, Christopher *(d)* 1A-A170
Smith, N. D. P. *(d)* 5-168
Smyth, Henry D. 1-97
Stacy, J. T. *(d)* 4-218
Starr, C. D. *(d)* 4-168
Streicher, M. A. *(d)* 1A-A176
Sully, A. H. *(d)* 2-160
Swain, A. J. *(d)* 1A-A188
Swindells, N. *(d)* 1A-A170
Sykes, C. *(d)* 3-164
Terry, C. A. *(d)* 4-256
Thomas, H. A. *(d)* 2-170
Thompson, James *(d)* 4-202
Thum, E. E. *(br)* 3-96
Tietz, L. S. *(d)* 4-168
Tigerschiöld, Magnus *(d)* 6-150
Tiller, W. A. *(d)* 4-228
Turner, Eugene L. *(d)* 6-176
van der Veen, J. H. *(d)* 1A-A139
Van Horn, Kent R. *(br)* 1-107
Van Loo, M. *(d)* 1A-A150
Van Zuilen, H. 2-103
VerSnyder, F. L. *(d)* 4-250
Vitt, George N. *(c)* 1-124
Waugh, H. C. *(d)* 1-150
Weeton, J. W. *(d)* 4-215
Westerman, A. B. *(d)* 1A-A191
White, H. E. 3-99
Wilhelm, H. A. *(d)* 4-161
Wilks, C. R. *(d)* 4-206
Williams, M. L. *(d)* 1A-A156
Winegard, W. C. *(d)* 4-228
Winterton, K. *(d)* 4-256
Wolfe, K. J. B. *(d)* 2-143
Wolfe, Paul E. *(d)* 1-184
Worden, Donald P. *(d)* 1A-A146
Wray, Robert I. 6-121
Wulff, John *(d)* 4-246
Zapffe, Carl Andrew ..... 3-89; *(br)* 4-127
Zlatnik, D. F. 3-107
Zonder, Arthur *(d)* 5-202

(*br*) Book Review; (*c*) Correspondence; (*cp*) Critical Points; (*d*) Digest; (*ds*) Data Sheet; (*lm*) Light Metallurgy; (*nb*) Notebook; (*sr*) Short Runs.